Scattered UV Radiation, Shade Structures and Vitamin D

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The health effects of solar UV radiation vary significantly, from assisting calcium absorption in humans due to the initiation of the synthesis of vitamin D_3 to the severe degradation of body tissue. The good effects are relatively few, but they are essential to the well being of humans. It is well known that exposure to small amounts of UVB (280 to 315 nm) radiation are beneficial for the human body and important in the production of vitamin D_3, whereas excessive exposure to UVB and UVA (315 to 400 nm) is known to cause skin cancer, DNA damage, immune suppression, erythema and sun-related eye disorders. It is estimated that approximately 90-95% of our vitamin D_3 requirement comes from exposure to the sun. Studies on the levels of UV measured in the shade of different shade environments have shown that the ratios of UVB to UVA in the shade are significantly different to that in full sun. The ratio of UVB to UVA is higher in the shade than in full sun. These differences are due to the phenomena of Rayleigh scattering ($\propto\lambda^{-4}$) and Mie scattering ($\propto\lambda^{-1}$) in the atmosphere, which causes greater scattering at the shorter UVB wavelengths compared to that at the longer wavelength UVA. Therefore, certain shaded environments may hold the effective wavelengths needed for vitamin D_3 production in the body, but not the high levels of UVA experienced in full sun. At certain latitudes and solar zenith angles, unprotected exposure for short periods to the UVB under shade structures may be the best course of action as it will contribute more toward vitamin D production than toward erythema compared to exposing the body to full sun UV due to the reduced relative component of the UVA in the shade.